US011163270B2

(12) **United States Patent**
Migneco et al.

(10) **Patent No.: US 11,163,270 B2**
(45) **Date of Patent: Nov. 2, 2021**

(54) **VEHICLE OCCUPANT DATA COLLECTION AND PROCESSING WITH ARTIFICIAL INTELLIGENCE**

(71) Applicant: **LEAR CORPORATION**, Southfield, MI (US)

(72) Inventors: **Francesco Migneco**, Saline, MI (US); **David Gallagher**, Sterling Heights, MI (US); **Mark Weaver**, Auburn Hills, MI (US); **Katie Rimell**, Redditch (GB)

(73) Assignee: **Lear Corporation**, Southfield, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 145 days.

(21) Appl. No.: **16/507,160**

(22) Filed: **Jul. 10, 2019**

(65) **Prior Publication Data**

US 2021/0011437 A1 Jan. 14, 2021

(51) **Int. Cl.**

G05B 13/00	(2006.01)
G05B 13/02	(2006.01)
G07C 5/08	(2006.01)
F24F 11/65	(2018.01)
F24F 11/30	(2018.01)
F24F 11/64	(2018.01)
H04L 29/08	(2006.01)

(52) **U.S. Cl.**

CPC ***G05B 13/0265*** (2013.01); ***F24F 11/30*** (2018.01); ***F24F 11/64*** (2018.01); ***F24F 11/65*** (2018.01); ***G07C 5/085*** (2013.01); ***H04L 67/12*** (2013.01)

(58) **Field of Classification Search**

CPC G05B 13/0265; G07C 5/085; G07C 5/008; G07C 5/0858; F24F 11/65; F24F 11/30; F24F 11/64; H04L 67/12; H04L 67/34; G06N 20/00; H04W 4/40; G06F 16/90; G06Q 10/04

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,802,246	B1 *	9/2010	Kennedy	G06F 8/61 717/173
8,186,230	B1 *	5/2012	Kelley	G01F 1/42 73/861.42
9,135,803	B1	9/2015	Fields et al.	
9,646,428	B1	5/2017	Konrardy et al.	
2009/0144909	A1 *	6/2009	Skinner	A61G 7/05776 5/713
2010/0217478	A1 *	8/2010	Zhang	G07C 5/006 701/31.4

(Continued)

OTHER PUBLICATIONS

Shah, Swati. Product marketing in the era of Internet of Things. Diss. Massachusetts Institute of Technology, 2018. (Year: 2018).*

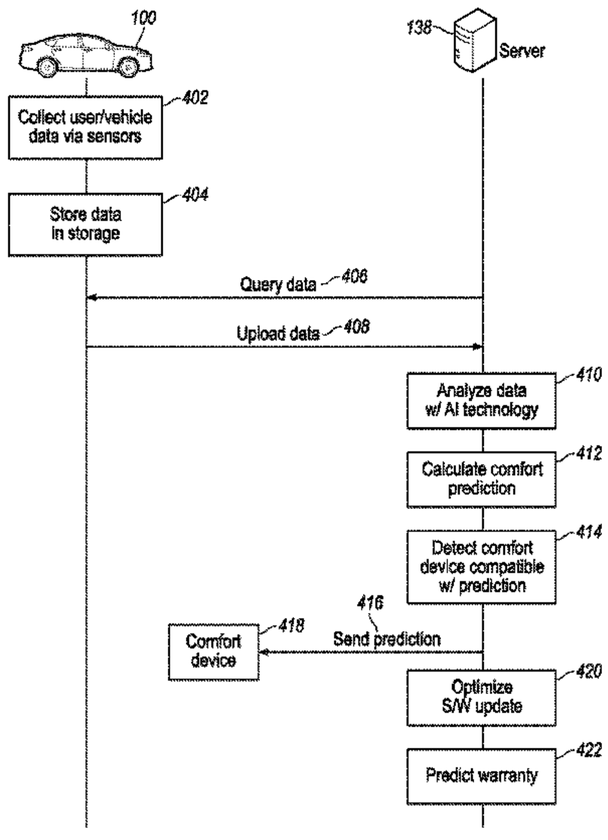
(Continued)

Primary Examiner — Michael D Masinick
(74) *Attorney, Agent, or Firm* — Brooks Kushman P.C.

(57) **ABSTRACT**

A server includes an interface, programmed to receive, from a vehicle, vehicle data indicative of vehicle status and user data indicative of usage of vehicle features by a user; and a processor, programmed to analyze the vehicle data and the user data using artificial intelligence (AI) logic to generate a comfort prediction for the user; and configure a comfort device associated with the user, external to the vehicle, using the comfort prediction.

20 Claims, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

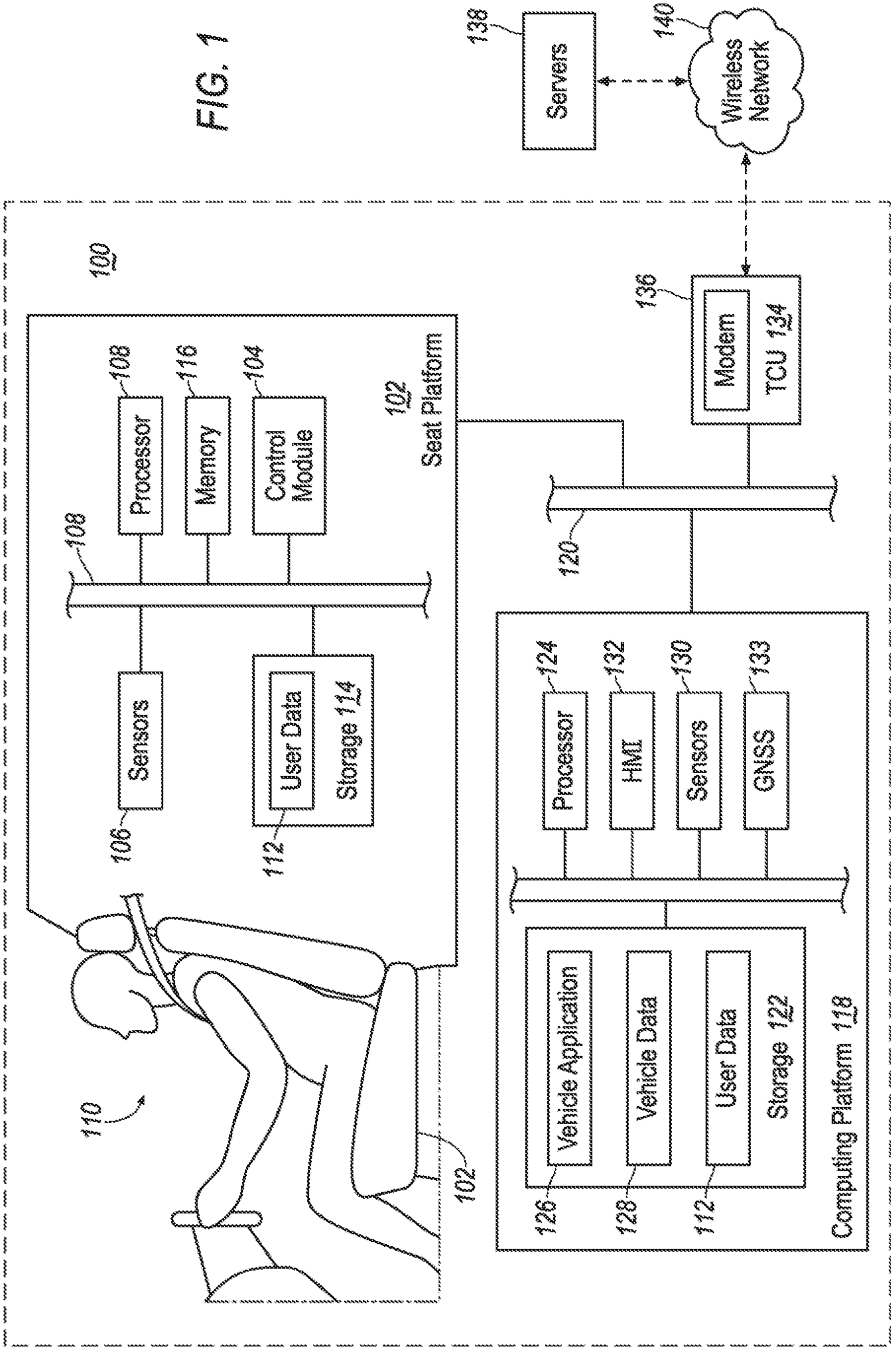
2013/0211669	A1*	8/2013	DePetro	B60N 2/002 701/36
2013/0332104	A1*	12/2013	Russell	A61B 5/6893 702/139
2014/0309790	A1*	10/2014	Ricci	G01C 21/3697 700/276
2014/0310788	A1*	10/2014	Ricci	G06F 21/31 726/6
2015/0065170	A1*	3/2015	Brisebois	H04W 4/023 455/456.3
2015/0292985	A1*	10/2015	Yenni	G05B 23/0221 702/182
2016/0129916	A1*	5/2016	Olsen	H04L 67/12 701/36
2017/0024201	A1	1/2017	Diedrich et al.	
2017/0113664	A1	4/2017	Nix	
2017/0305349	A1*	10/2017	Naboulsi	B60R 1/025
2018/0203708	A1*	7/2018	Carey	G06F 21/31
2018/0319402	A1*	11/2018	Mills	B60W 30/10
2019/0106037	A1*	4/2019	Mankame	A47C 7/20
2019/0138293	A1*	5/2019	Shrivastava	G06F 8/36
2019/0146442	A1*	5/2019	Cirino	H04W 68/005 700/9
2020/0216077	A1*	7/2020	Nolscher	H04W 76/14
2020/0252498	A1*	8/2020	Iyer	H04W 4/029
2021/0031786	A1*	2/2021	Gallagher	B60W 50/0098

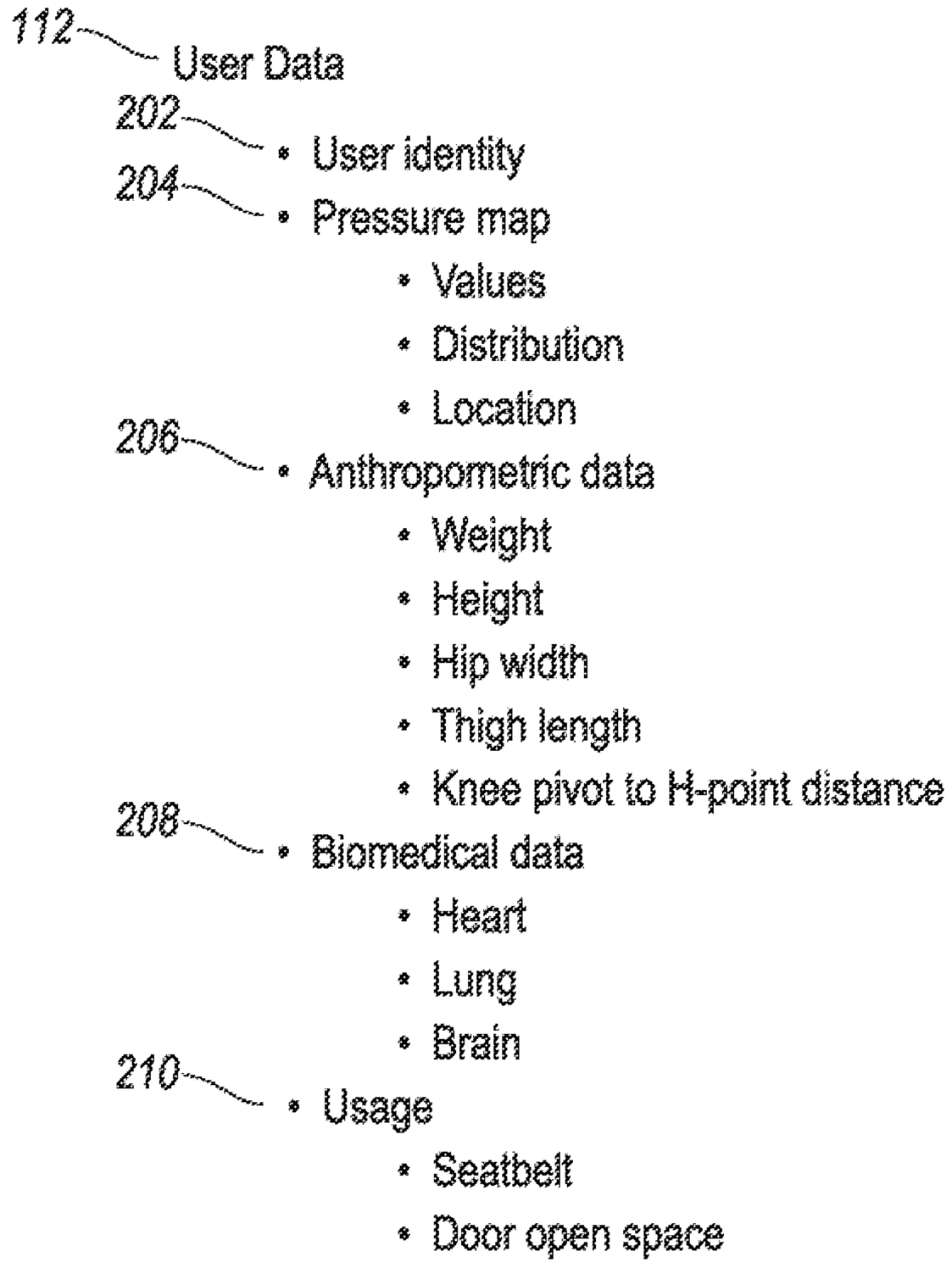
OTHER PUBLICATIONS

"Automakers Embrace Over-the-Air Updates, but Can We Trust Digital Car Repair?", Consumer reports, Apr. 20, 2018 (Year: 2018).*

* cited by examiner

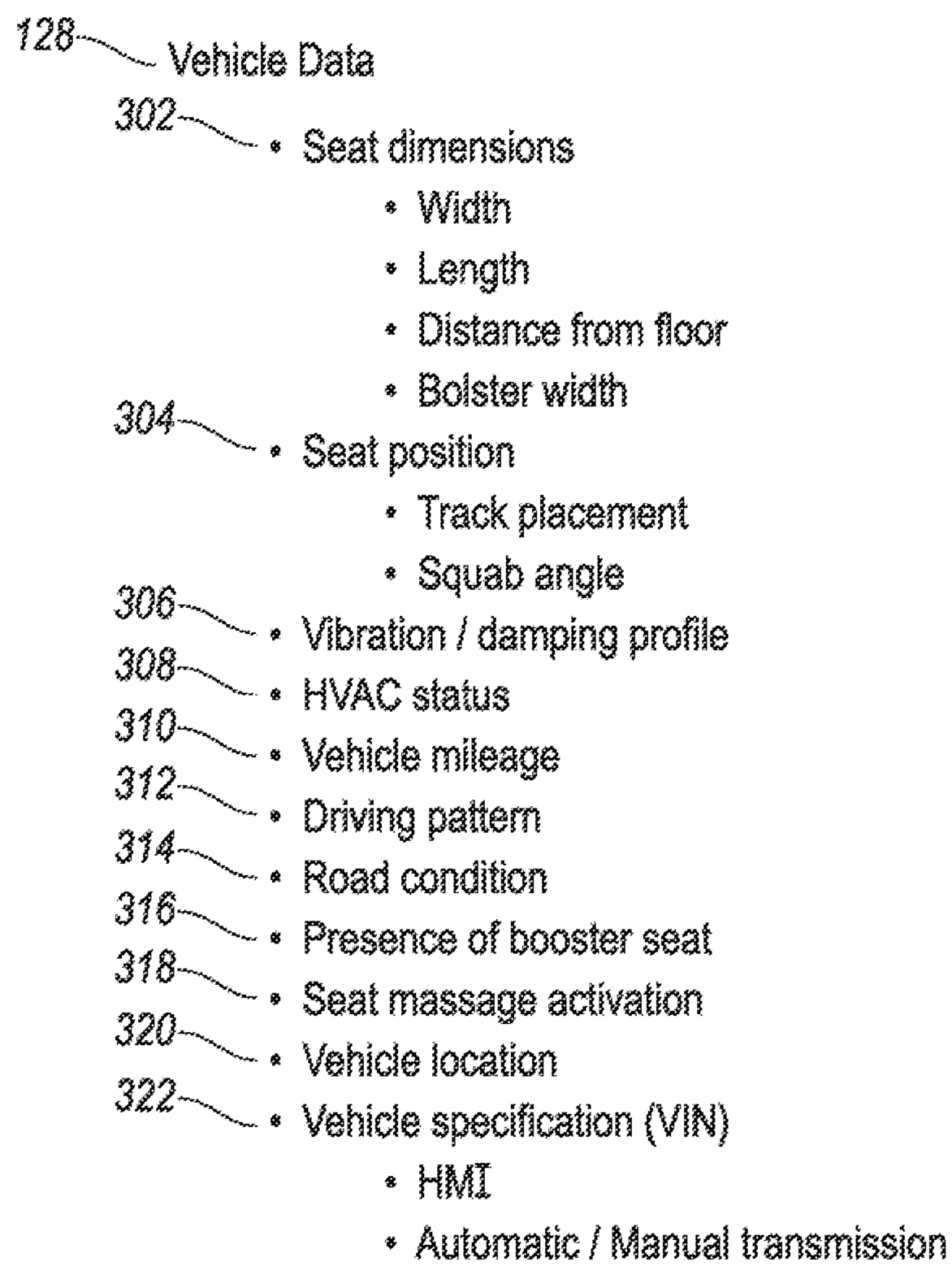
FIG. 1


138
Servers
140
Wireless Network
100
136
Modem
TCU 134
102
Seat Platform
108
Processor
116
Memory
104
Control Module
106
Sensors
112
User Data
Storage 114
120
124
Processor
132
HMI
130
Sensors
133
GNSS
126
Vehicle Application
128
Vehicle Data
112
User Data
Storage 122
Computing Platform 118
110
102



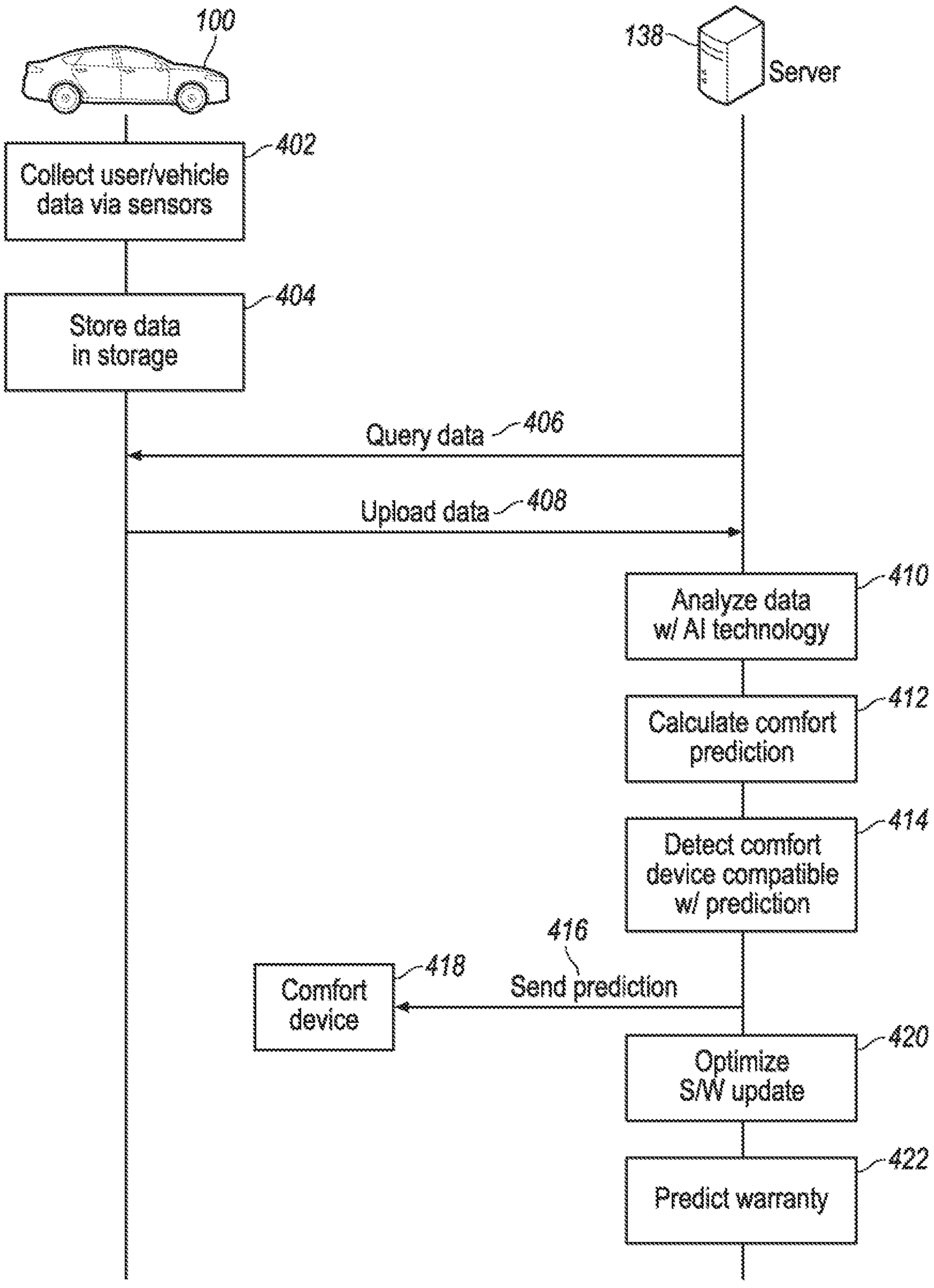
200

FIG. 2



300

FIG. 3


100
138
Server
Collect user/vehicle data via sensors
402
Store data in storage
404
Query data
406
Upload data
408
Analyze data w/ AI technology
410
Calculate comfort prediction
412
Detect comfort device compatible w/ prediction
414
416
Send prediction
Comfort device
418
Optimize S/W update
420
Predict warranty
422

400

FIG. 4

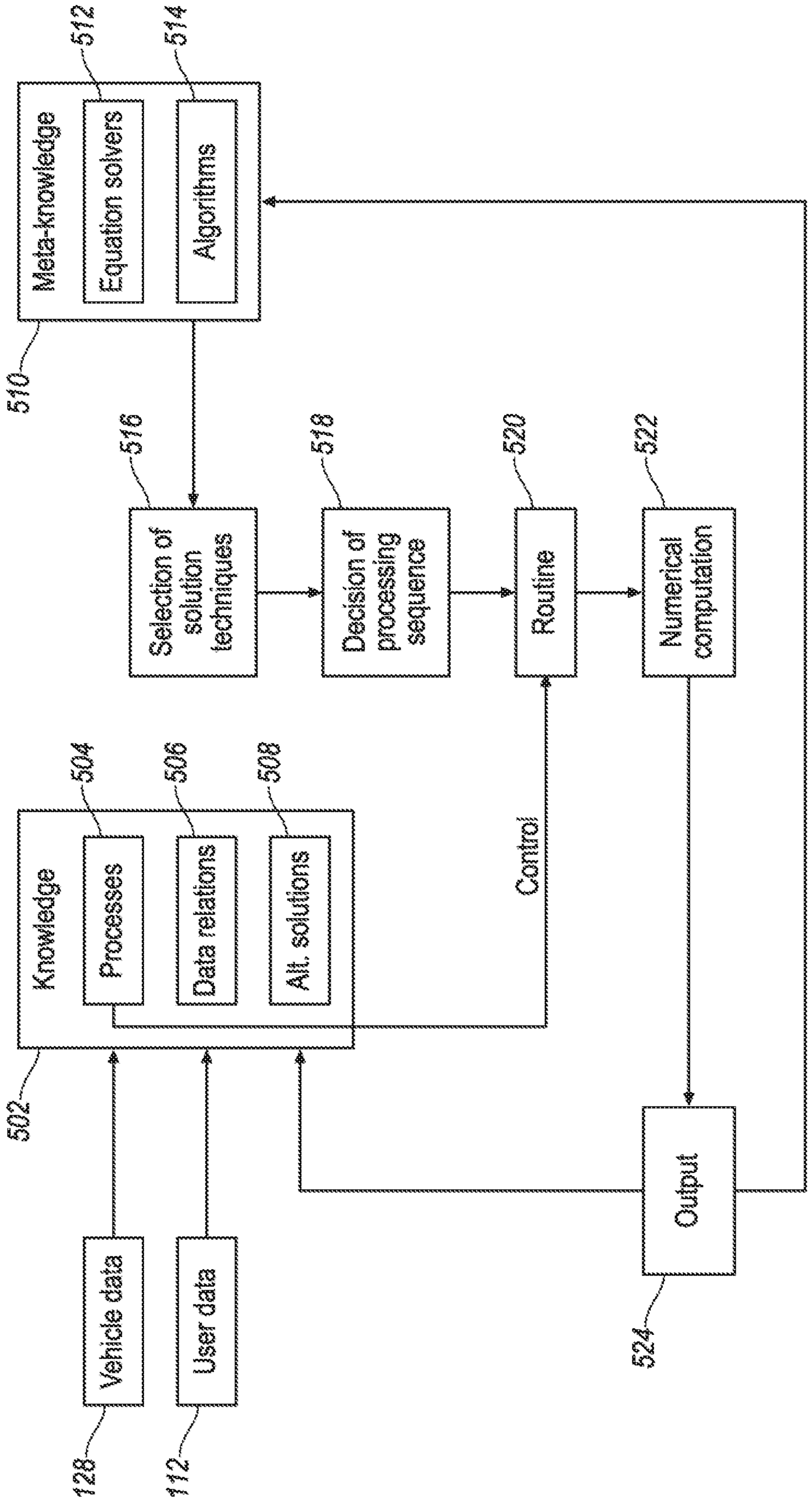

AI Logic 500
Meta-knowledge
Equation solvers
Algorithms
512
514
510
Selection of solution techniques
Decision of processing sequence
Routine
Numerical computation
516
518
520
522
Control
Knowledge
Processes
Data relations
Alt. solutions
504
506
508
502
Vehicle data
User data
128
112
Output
524

FIG. 5

VEHICLE OCCUPANT DATA COLLECTION AND PROCESSING WITH ARTIFICIAL INTELLIGENCE

TECHNICAL FIELD

The present disclosure generally relates to a vehicle occupant data collection and processing system. More specifically, the present disclosure relates to a vehicle system for collecting occupant data and a server for analyzing the data using artificial intelligence (AI) technologies.

BACKGROUND

Many vehicles are provided with comfort features, such as heating, ventilation, and air conditioning (HVAC), seat massage, or the like. Sensors may be used to collect data for vehicle users and usage of those features. The data collected by sensors may be useful for vehicle manufacturers to determine the usage pattern of those features to optimize vehicle software update and improve design for future vehicles.

SUMMARY

In one or more illustrative embodiments of the present disclosure, a server includes an interface, programmed to receive, from a vehicle, vehicle data indicative of vehicle status and user data indicative of usage of vehicle features by a user; and a processor, programmed to analyze the vehicle data and the user data using artificial intelligence (AI) logic to generate a comfort prediction for the user; and configure a comfort device associated with the user, external to the vehicle, using the comfort prediction.

In one or more illustrative embodiments of the present disclosure, a method for a server includes receiving, from multiple vehicles, vehicle data indicative of vehicle status and user data indicative of usage of vehicle features of multiple users; analyze the vehicle data and the user data using an artificial intelligence (AI) logic to generate an analysis result indicative of a usage pattern of multiple vehicle features; and optimize a vehicle software update based on the analysis result.

In one or more illustrative embodiments of the present disclosure, a non-transitory computer-readable medium includes instructions that, when executed by a processor of a computer, cause the processor to query, with vehicles, vehicle data indicative of vehicle status and user data indicative of usage of vehicle features of multiple users from the vehicles; responsive to receiving, from multiple vehicles, the vehicle data and the user data, analyze the vehicle data and the user data using an artificial intelligence (AI) logic to generate an analysis result indicative a usage pattern of multiple vehicle features by the users; and output a warranty claim prediction based on the usage pattern of multiple vehicle features.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how it may be performed, embodiments thereof will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

FIG. **1** illustrates an example block topology of a vehicle system of one embodiment of the present disclosure;

FIG. **2** illustrates an example diagram for user data of one embodiment of the present disclosure;

FIG. **3** illustrates an example diagram for vehicle data of one embodiment of the present disclosure;

FIG. **4** illustrates an example data flow diagram of one embodiment of the present disclosure; and

FIG. **5** illustrates an example block diagram of an AI logic of one embodiment of the present disclosure.

DETAILED DESCRIPTION

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

The disclosure generally provides for a plurality of circuits or other electrical devices. All references to the circuits and other electrical devices and the functionality provided by each, are not intended to be limited to encompassing only what is illustrated and described herein. While particular labels may be assigned to the various circuits or other electrical devices. Such circuits and other electrical devices may be combined with each other and/or separated in any manner based on the particular type of electrical implementation that is desired. It is recognized that any circuit or other electrical device disclosed herein may include any number of microprocessors, integrated circuits, memory devices (e.g., FLASH, random access memory (RAM), read only memory (ROM), electrically programmable read only memory (EPROM), electrically erasable programmable read only memory (EEPROM), or other suitable variants thereof) and software which co-act with one another to perform operation(s) disclosed herein. In addition, any one or more of the electric devices may be configured to execute a computer-program that is embodied in a non-transitory computer readable medium that is programed to perform any number of the functions as disclosed.

The present disclosure, among other things, proposes a vehicle system for collecting vehicle data and vehicle user data via various sensors and store data in a storage. Vehicle data and user data may be uploaded to a cloud server for analysis to determine user comfort preference with which comfort devices (e.g. chairs, sofas or the like) separated from the vehicle may be configured, to provide a good user experience. Additionally, the comfort preference may be used to configure a comfort device within vehicles (e.g. another vehicle seat, or seat of another vehicle). Additionally, with data received from multiple vehicles and users, the cloud server may further analyze data collectively and determine usage patterns for various vehicle features, and therefore predict warranty claims, insurance disputes over certain period of time. Based on the user most frequent predicted patterns/preferences, the cloud server may optimize and improve vehicle software updates in an "off-the-shelf" manner and may perform customizations.

FIG. **1** illustrates an example diagram of a system **100** that may be used for the vehicle integration scheme. The vehicle (not shown) may include various types of automobile, crossover utility vehicle (CUV), sport utility vehicle (SUV), truck, recreational vehicle (RV), boat, plane, or other mobile machine for transporting people or goods. In many cases, the vehicle may be powered by an internal combustion engine.

As another possibility, the vehicle may be a hybrid electric vehicle (HEV) powered by both an internal combustion engine and one or move electric motors, such as a series hybrid electric vehicle (SHEV), a parallel hybrid electric vehicle (PHEV), or a parallel/series hybrid vehicle (PSHEV), a boat, a plane or other mobile machine for transporting people or goods.

The vehicle **100** may include one or more seats **102**. As illustrated in FIG. **1**, a seat platform **102** may include a control module **104** configured to control the operation of the seat platform **102** to provide various features such as seat angle adjustment, cooling/heating, massage or the like. The control module **104** may further include one or more sensors **106**, in communication with the control module **104** via a seat network **108**, configured to collect data of a vehicle user **106**. The sensors **104** may include various types of sensors, including but not limited to, a pressure sensor, a piezo-electric-resistive sensor, or a Doppler radar sensor. These sensors **104** may be used to collect physical and/or anthropometric data of the user **106**. Data collected by the sensors **104** may be sent to one or more processors **108** for processing and generating a user data **112**. The user data may be transmitted to a seat storage **114** via a memory **116** for storage. The seat storage **114** may include a non-transitory storage medium configured to store the user data in a non-volatile manner. Additionally or alternatively, the sensor data and/or user data **112** may be sent to a computing platform **118** via a in-vehicle network **120** for processing and storage. The computing platform **118** may include a non-volatile storage **122** to store the user data **112** as received. The in-vehicle network **120** may include, but is not limited to, one or more of a controller area network (CAN), a local interconnect network (LIN) an Ethernet network, and a media-oriented system transport (MOST), as some examples.

The computing platform **118** may include a non-volatile storage to store the user data **120**. The computing platform **118** may further include one or more processors **124** configured to perform instructions, commands, and other routines in support of the processes described herein. For instance, the computing platform **118** may be configured to execute instructions of vehicle application **126** stored in the storage **122** to provide perform sensor data processing features. Furthermore, the computing platform **118** may be configured to collect vehicle data **128** via one or more vehicle sensors **130** and store the vehicle data **128** in the storage **122**. The vehicle data **128** may be indicative of various vehicle settings/status (e.g. HVAC settings, location data or the like) associated with the vehicle **100**. It is noted that the term sensors is used as a general term in the present disclosure and may include any device/component provided with sensing or signal collection capabilities to collect data related to any aspect of vehicle operation or condition. For instance, sensors **130** may include a speed sensor, a vibration sensor, a camera, a seatbelt sensor, a light sensor or the like. The computing platform **118** may be provided with various features allowing the vehicle occupants/users to interface with the computing platform **118**. For example, the computing platform **118** may output to and receive input from human-machine interface (HMI) controls **132** configured to provide for user interaction with the vehicle. As an example, the computing platform **118** may interface with one or more buttons (not shown) or other HMI controls configured to invoke functions on the computing platform **118** (e.g., steering wheel audio buttons, a push-to-talk button, instrument panel controls, etc.). The computing platform **118** may further include a global navigation satellite system (GNSS) controller **133** configured to communicate with multiple satellites and calculate the location of the vehicle **100**. The GNSS controller **133** may be configured to support various current and/or future global or regional location systems such as global positioning system (GPS), Galileo, Beidou, Global Navigation Satellite System (GLONASS) and the like.

The seat platform **102** and the computing platform **118** may be further configured to communicate with a telematics control unit (TCU) **134** via the in-vehicle network **120**. The TCU **134** may include one or more wireless modem **136** configured to connect the TCU **134** to a remote server **138** via a wireless network **140** to provide network connectivity. It is noted that the term wireless network and server are used as general terms in the present disclosure and may include any computing network involving carriers, router, computers, controllers or the like configured to communicate, store data and perform data processing functions and facilitate communication between various entities.

Referring to FIG. **2**, an example diagram **200** for user data of one embodiment of the present disclosure is illustrated. With continuing reference to FIG. **1**, the user data **112** may include multiple entries to record various aspects of the user and his/her usage pattern. For instance, the user data **112** may include a user identity entry to identify the user **110**. One vehicle **100** may be shared by multiple users and identification of the users may be important. The computing platform **118** may be configured to identify the user **110** via various means such biometric identification (e.g. fingerprint or facial recognition) using a fingerprint reader or camera **130**. Additionally or alternatively, the computing platform **118** may be further configured to identify the user **110** using a mobile device (not shown) associated with the user **110** and connected to the computing platform **118** via a wired or wireless connection. The user data **112** may further include a pressure map entry **204** to record a seating pressure map of the user **110** reflecting seating position and pressure distribution of the user **110**. The pressure map entry **204** may include data collected from the sensors **106** such as pressure values, distribution, location or the like reflecting a seating condition of the user **110**. The user data **112** may further include an anthropometric data entry **206** to record measurement and/or proportions of the body of the user **110** detected by the sensors **106**. For instance, the anthropometric data entry **206** may include weight, height, hip width, shoulder width, waist width, thigh length, knee pivot to hip-point (H-point) distance, or the like. The user data **112** may further include a biomedical data entry **208** to record measurement of the user **110**. For instance, the biomedical data entry **208** may include heart rate data, lung data (e.g. breath), and/or brain data (e.g. electroencephalography). The user data **112** may further include a usage entry **210** to record usage measurement associated with the user **110**. For instance, the usage entry **210** may record usage of seatbelt and door open space associated with the user **110**. The seatbelt usage may reflect wear on the bolster and cushions where the seat belt touches the fabric, which may help to predict wear and damages and improve material design for future designs. Similarly, the door open space may be related to ingress/egress wear on the seat cushion as in some instances, the user **110** may need to "slide" down the edge due to the door space, increasing wear on the cushion.

Referring to FIG. **3**, an example diagram **300** for user data of one embodiment of the present disclosure is illustrated. With continuing reference to FIGS. **1** and **2**, the vehicle data **128** may include multiple entries to record various aspects of vehicle operations. For instance, the vehicle data **128** may

include a seat dimensions entry **302** to record the dimensions of vehicle seats **102**. The vehicle seats may include a driver seat, as well as any passenger seat within the vehicle **100**. The seat dimensions entry may include a width, length, distance from floor, or bolster width of the vehicle seat **102**. The vehicle data **128** may further include a seat position entry **304** to record position/configuration of the seat **102**. As a few non-limiting examples, the seat position entry **304** may include track placement indicative of a sliding position of the seat **102** on a track, a seat squab angle, air bladder (for massage or posture) inflation level, pressure, or the like. The seat dimensions **302** and seat position **304** entries may be particular useful for adjustable seats to determine usage preference of vehicle seats **102** associated with each user **110**. The vehicle data **128** may further include a vibration/damping profile **306** via signals detected by the sensors **130**. The vehicle data **128** may further include a HVAC status/pattern entry **308** via signal collected from a HVAC controller (not shown) indicative of vehicle cooling/heating usage status/pattern. The vehicle data **128** may further include vehicle mileage entry **310** from a vehicle odometer indicative of a total mileage the vehicle **100** has been operated. The vehicle data **128** may further include a vehicle driving pattern **312** (e.g. short, long trips) and road condition entry **314** (e.g. normal, snow). The vehicle data **128** may further include an entry for presence of booster seats **316** detected via seat sensors **106** and/or seatbelt sensors **130**. The vehicle data **128** may further include an entry for seat massage feature activation **318** indicative of the usage (e.g. time of the day, duration or the like) of one or more massage functions associated with the user **110**. The vehicle data **128** may further include a vehicle location entry **320** configured to record/report vehicle location at a given time using location data from the GNSS controller **133**. The vehicle data **128** may further include a vehicle specification entry **322** to record vehicle specifications. For instance, the vehicle specification entry **322** may include an HMI configuration (e.g. buttons on the steering wheel, voice control and etc.), automatic/manual transmission record or the like, which may affect vehicle wear. For instance, the availability of steering wheel buttons and voice control may reduce user forward and backward movement on the seat, and thus reducing seat wear and tear. Similarly, automatic transmission may reduce movement for the user left foot reducing seat wear.

Referring to FIG. **4**, an example data flow diagram for a process **400** of one embodiment of the present disclosure. With continuing reference to FIGS. **1** to **3**, at operation **402**, the vehicle **100** collects data via seat sensors **106** and vehicle sensors **130**. In one example, the seat platform **102** and the computing platform **118** may be configured to operate separately by collecting user data **112** via seat sensors **106** and collecting vehicle data **128** via vehicle sensors **130** respectively. As another example, the seat platform **102** and the computing platform **118** may operate collectively to collect and store the user and vehicle data **112**, **128**. At operation **404**, the vehicle **100** stores the collected user and vehicle data **112**, **128** in the storage **114**, **122**. Here, similarly, the seat platform **102** and the computing platform **118** may store the data separately or collectively depending on the specific configuration of the vehicle **100**. In some examples, the seat platform **102** may be provided with only limited storage capability. If this is the case, the user data **112** and the vehicle data **128** may be stored collectively in the storage **122** of the computing platform **118**. The user data **112** and the vehicle data **128** may be stored in the storage **122** in a "black-box" manner for privacy protection. In this case, data collected by sensors may be encrypted before storage.

At operation **406**, the server queries the user data **112** and vehicle data **128** from the vehicle **100**. The server **138** may query all user data **112** and vehicle data **128** stored in the storage **122**. Alternatively, the server **138** may query only a part of the user data **112** and vehicle data **128** by specifying conditions (e.g. time, entry name or the like) of data. Responsive to receiving the query, at operation **408** the computing platform **118** uploads the user data **112** and vehicle data **128** to the server **138** for processing and analysis. Alternatively, the computing platform **118** may be configured to automatically upload the user data **112** and vehicle data **128** to the server **138** in a real-time manner or periodically at a predefined interval without receiving queries from the server **138**. In case the data received from the vehicle **100** is encrypted, the server **138** may be configured to decrypt the data first before starting to analysis.

At operation **410**, responsive to receiving the user data **112** and vehicle data **128** from the vehicle **100**, the server **138** analyze the data received using AI technologies (to be described in detail below). As a part of the data analysis, at operation **412**, the server **138** may calculate a comfort prediction configured to operate comfort setting of comfort devices associated with the same user **110**. For instance, by analyzing usage patterns of features such as HVAC status entry **308** and the seat massage activation entry **318** of the vehicle data **128**, the server **138** may determine the comfort prediction associated with the user **110**. The comfort prediction may apply to not only the vehicle setting, but also the compatible comfort devices in an office or home setting. For instance, a sofa provided with massage functions may be associated with the user **110** at home. Additionally, a home air-conditioner (AC) of the user **110** may be adjusted remotely. With the comfort prediction determined, the server **138** may operate those comfort devices (e.g. the sofa and AC) using the comfort prediction to provide the user **110** with better user experience. At operation **414**, the server **138** detects the comfort devices and determines compatibility between the devices and comfort prediction. A comfort device may be fully or partially compatible with the comfort prediction. Continuing to use the example of a sofa mentioned above, for instance, the sofa may be provided with massage features, which are different from the massage features used by the user in the vehicle **100**. In this type of partially compatible situation, the server **138** may further determine the sofa massage functions that are the most similar to those the user **110** used in the vehicle **100** to modify the comfort prediction. As an example, if the user uses waist and neck massage features in the vehicle **100** and the sofa is only provided with waist massage, the server **138** may modify the comfort prediction for the sofa to be waist massage only. At operation **416**, the server **138** sends the comfort prediction (as original or modified) to the comfort devices **418**.

In addition to the comfort prediction, the AI analysis of the server **138** may further optimize software updates to the vehicle system at operation **420**. These operations may be based on analyzing a number of vehicles and obtaining extensive statistics of vehicle usage patterns. A vehicle identification number (VIN) of multiple vehicles **100** may be tracked and submitted to the server **138** as a part of vehicle data from each vehicle. The server **138** may determine software versions and available features of each vehicle through the VIN number as received. Through analyzing usage rate and pattern for features across a number of

vehicles, the server **138** may determine an optimized software update version for current and future vehicle lineups based on the usage. For instance, if certain models of vehicle seats **102** are provided with multiple comfort features (e.g. five features) but the usage pattern determined by the server **138** indicates usage rate of different features varies by geographic locations, software update may be coordinated accordingly. For instance, the server **138** may push a vehicle software update to vehicle in the north to automatically activate seat heating when the cabin temperature is below a threshold determined by the usage pattern. Similarly, the server **138** may further push a vehicle software update to vehicle in the south to automatically activate seat cooling when the cabin temperature is above a threshold determined based on the usage pattern. At operation **422**, the server **138** further predicts warranty/insurance claims based on the usage pattern determined. For instance, more heavily used features may increase the likelihood for warranty/insurance claims for vehicle components related to those features.

Referring to FIG. **5**, an example AI logic block diagram **500** of one embodiment of the present disclosure is illustrated. The AI logic **500** may be implemented via a processor of the server **138** as an example. With continuing reference to FIGS. **1** to **4**, a knowledge engine **502** receives user data **112** and the vehicle data **128** for processing and analysis. The knowledge engine **502** may include a process engine **504** configured to operation various processes of data analysis, a data relation engine **506** configured to evaluate and determine relationships of various data as received, and an alternative solution engine **508** configured to determine alternative solutions for comfort predictions, update optimizations, and/or warranty predictions. The AI logic **500** may further include a meta-knowledge engine **510** having an equation solver engine **512** configured to process mathematical solutions, and an algorithm engine **514** incorporating various AI algorithms for data processing. As a few non-limiting examples, the AI algorithms may include Neural Network, Data Classifiers, Linear Regression, Logistic Regression, Decision Tree, Support Vector Machine, Naïve Bayes, K-Nearest Neighbors, K-Means, Random Forest, Dimensionality Reduction, and/or Gradient Boosting and AdaBoost.

A selection of solution techniques **516** may be determined based on the meta-knowledge engine **510**. At **518**, the AI logic may make decisions on processing sequence based on the solution techniques **516** and processing results of the knowledge engine **502**, and may operate processing routines at **520**. The routines **520** may further take input from the process engine **504** to optimize the operation. processing results of the routine **520** may then be subject to numerical computation at **522** and eventually generates output results at **524**. The AI logic may be configured to provide the output results **524** to the knowledge engine **502** and the meta-knowledge engine **510** as feedback to improve the processing operations.

In another embodiment, parallel AI logics can be deployed concurrently depending upon use case and timing. For instance, unsupervised methods like clustering and/or dimension reduction techniques can be deployed at the vehicle level and/or network level (e.g. server **138**) to provide the real-time comfort predictions and enact countermeasures. Meanwhile, supervised techniques like classification and regression can occur at the network level to both handle warranty use cases as well as overall population comfort information for large scale adjustments to a fleet.

While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

What is claimed is:

1. A server, comprising:

an interface, programmed to receive, from a plurality of vehicles, vehicle data indicative of vehicle status and user data indicative of usage of vehicle features by a plurality of users; and

a processor, programmed to

analyze the vehicle data and the user data using artificial intelligence (AI) logic to generate an analysis result indicative of a comfort prediction for the users, a first vehicle feature of the vehicle features being more often used by vehicles at a first location, and a second vehicle feature of the vehicle features being more often used by vehicles at a second location;

configure a comfort device associated with the users, external to the vehicles, using the comfort prediction;

pushing a first software update version to vehicles at the first location to automatically activate the first feature; and

pushing a second software update version to vehicles at the second location to automatically activate the second feature.

2. The server of claim **1**, wherein the processor is further programmed to

query the vehicle data and the user data from the vehicle.

3. The server of claim **1**, wherein the user data further includes: a user anthropometric entry indicative of a weight and height of the user.

4. The server of claim **3**, wherein the user data further includes electroencephalography data of the user.

5. The server of claim **1**, wherein the vehicle data includes a seat dimension entry, a seat position entry, and a seat massage activation entry.

6. The server of claim **5**, wherein the vehicle data further includes at least one of: a vehicle vibration/damping entry, a heating, ventilation, and air conditioning entry, a vehicle mileage entry, a driving pattern entry, a road condition entry, a presence of booster seat entry, or a vehicle location entry.

7. The server of claim **1**, wherein the comfort prediction includes at least one of a seat position setting, a seat massage setting, or a heating, ventilation, and air conditioning setting.

8. The server of claim **7**, wherein the comfort device includes at least one of: a seat, or a building climate control system, and

the processor is further programmed to configure a second comfort device associated with the vehicle using the comfort prediction, the second comfort device being at least one of: a vehicle seat or a vehicle heating, ventilation, and air conditioning system.

9. The server of claim **1**, wherein the processor is further programmed to

detect the comfort device is available; and

responsive to verifying the comfort device is compatible with the comfort prediction, configure the comfort device using the comfort prediction.

10. The server of claim 1, wherein the processor is further programmed to

analyze vehicle data and user data from multiple vehicles using the AI logic to generate an analysis result indicative a usage pattern of multiple vehicle features; and

select a version of software update based on the analysis result corresponding to the usage pattern of multiple vehicle features.

11. The server of claim 1, wherein the processor is further programmed to

predict a warranty claim based on the analysis result.

12. A method for a server, comprising:

receiving, from multiple vehicles, vehicle data indicative of vehicle status and user data indicative of usage of vehicle features by multiple users;

analyzing the vehicle data and the user data using artificial intelligence (AI) logic to generate an analysis result indicative of a usage pattern of multiple vehicle features, wherein the usage pattern is indicative of a first vehicle feature of the vehicle features being more often used by vehicles at a first location, and a second vehicle feature of the vehicle features being more often used by vehicles at a second location;

pushing a first software update version to vehicles at the first location to automatically activate the first feature; and

pushing a second software update version to vehicles at the second location to automatically activate the second feature.

13. The method of claim 12, further comprising:

predicting a warranty claim based on the analysis result.

14. The method of claim 12, further comprising:

configuring a comfort device associated with at least one user, external to the vehicle using the analysis result.

15. The method of claim 14, wherein the comfort device includes at least one of: a seat, or a building climate control system.

16. The method of claim 12, further comprising:

configuring a second comfort device associated with the vehicle using the analysis result, the second comfort device being at least one of: a vehicle seat or a vehicle heating, ventilation, and air conditioning system.

17. A non-transitory computer-readable medium, comprising instructions that, when executed by a processor of a computer, cause the processor to:

query vehicles for vehicle data indicative of vehicle status and user data indicative of usage of vehicle features by multiple users;

responsive to receiving, from the vehicles, the vehicle data and the user data, analyze the vehicle data and the user data using artificial intelligence (AI) logic to generate an analysis result indicative a usage pattern of multiple vehicle features by the users, wherein the usage pattern is indicative of a first vehicle feature of the vehicle features being more often used by vehicles at a first location, and a second vehicle feature of the vehicle features being more often used by vehicles at a second location; and

output a warranty claim prediction based on the usage pattern of the multiple vehicle features.

18. The non-transitory computer-readable medium of claim 17, further comprising instructions that, when executed by the processor of the computer, cause the processor to:

pushing a first software update version to vehicles at the first location to automatically activate the first feature; and

pushing a second software update version to vehicles at the second location to automatically activate the second feature.

19. The non-transitory computer-readable medium of claim 17, wherein the analysis result is further indicative of a comfort prediction for at least one user,

the non-transitory computer-readable medium further comprising instructions, when executed by a processor of a computer, cause the computer to:

configure a comfort device associated with the user, external to the vehicles, using the comfort prediction.

20. The non-transitory computer-readable medium of claim 19, wherein the comfort device includes at least one of: a seat, or a building climate control system.

* * * * *